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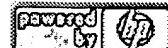
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# Tik-76.115 User Manual

## MobileDNS - DNS for mobile use

<http://www.hut.fi/~jkleimo/MobileDNS/documents/LU/ko.html>

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# 1. Introduction

## 1.1 This Document

This document is targeted for the end-user of the MobileDNS software system. The document starts with an overview of MobileDNS where the general purpose and objectives of the software is outlined. The installation steps and configuration of MobileDNS are covered next. Finally, the two components of the MobileDNS software and their usage is explained.

This document assumes that the user is familiar with the standard Domain Name Service (DNS) and its architecture. It also helps to have an understanding of networking in general and of Linux operating system.

## 1.2 Project Background

MobileDNS software was developed for a course "Tik-76.115 Software Project" at the Helsinki University of Technology during fall 1998 and spring 1999.

The project workgroup consists of the following members: Antti Heinilä, Johannes Kleimola, Tomi Mickelsson, Jani Mäkelä and Juuso Pajunen.

The customer of the project is Hannu Kari. The project supervisor is Mikko Tiusanen.

## 1.3 Overview

The purpose of the MobileDNS software is to enhance the utilization of standard Domain Name Service in mobile use.

DNS is a widely accepted standard mechanism on the Internet for performing lookups from a domain name to an IP-address. MobileDNS is not going to change this fact. However, a typical DNS-client software being distributed with the current operating systems is usually bound to the home network and its DNS-servers. The addresses of the DNS-servers are statically configured to

the DNS-client. This is not desirable in a mobile environment where a mobile computer moves from one network to another. In addition, a typical DNS-client software has no local cache to store the most frequently used DNS records locally and hence can't minimize the DNS traffic to the Internet. MobileDNS has been created to address these issues.

MobileDNS is intended to be run on a mobile computer that moves from one network to another. MobileDNS software has the following main objectives:

**Use the nearest DNS-servers of the visited network** MobileDNS directs the DNS-traffic originating from the mobile computer to the nearest DNS-servers of the network being visited. When the mobile computer moves to another network, MobileDNS is notified of this change and the list of nearest DNS-servers is updated.

**Minimize DNS-traffic** MobileDNS minimizes the traffic to the DNS-servers by keeping a cache of most used DNS records. The leading idea is that each packet sent to the network costs money. Less traffic is better.

**Be transparent to the user** MobileDNS runs transparently on the background. During normal operation, user intervention is not required.

**Follow the DNS-standard** MobileDNS provides a standard DNS service for the client applications running on the mobile computer. There is no need to modify the existing software applications.

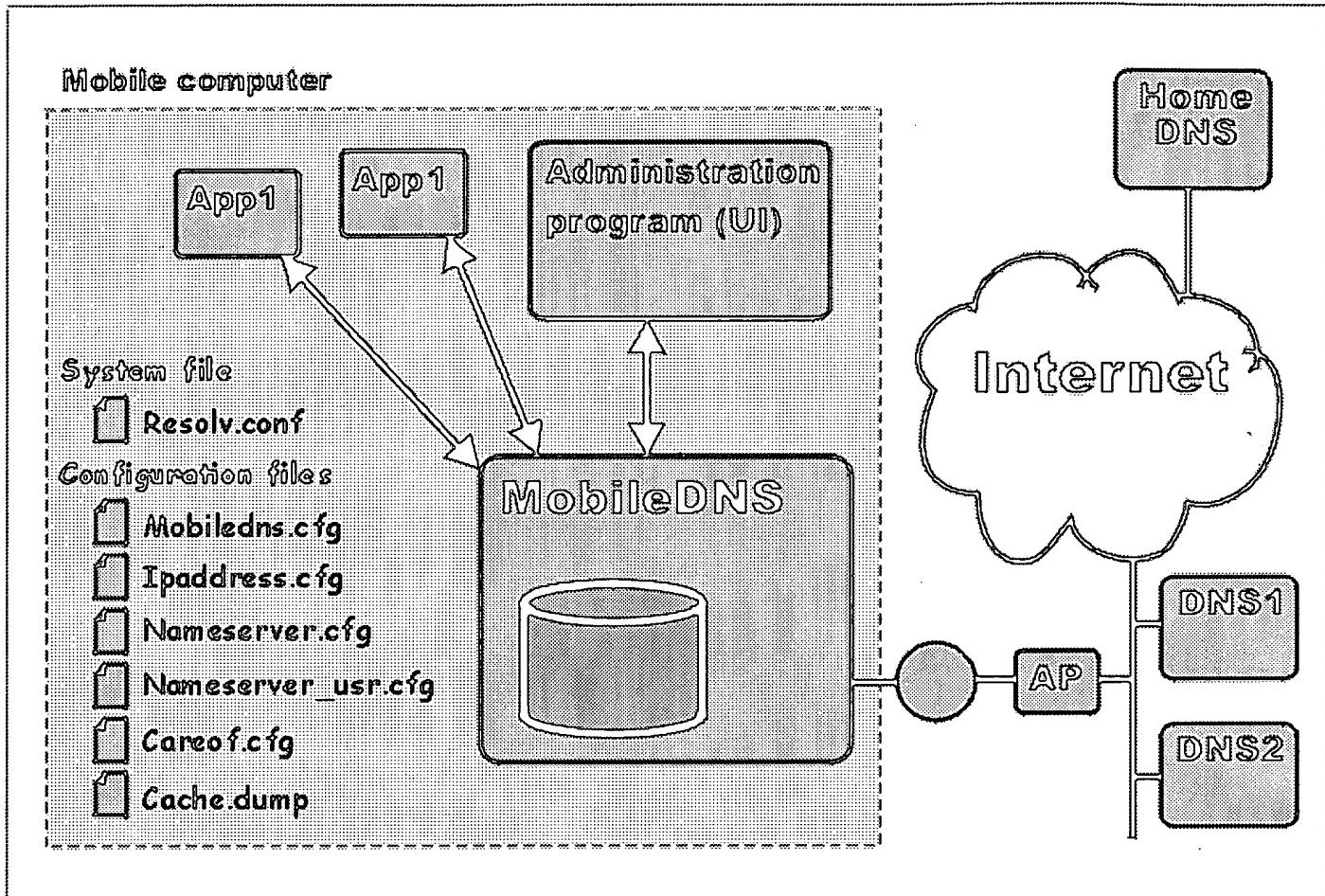
**Keep the domain name bound to the present location** MobileDNS can update its current IP-address to the home DNS-server located on the home network. This feature makes it possible for other hosts on the Internet to reach the mobile computer via its domain name.

It should be noted that MobileDNS software is partly a prototype-software and it doesn't work automatically as it is with the current Internet infrastructure. MobileDNS is designed to work in cooperation with a network component called access point. Access point is supposed to notify MobileDNS upon arrival to a new foreign network and provide the necessary data of the new network (like the IP-addresses of the DNS-servers of the new network). Since such a component is not available on the Internet today, MobileDNS has another mechanism for providing the data: system signals and configuration files. This mechanism makes it possible to take advantage of MobileDNS in a contemporary network environment even if access point components are not available. The mechanism is explained in the document.

## 1.4 Software Components

MobileDNS software system consists of two executable components, a MobileDNS service and an administration program. MobileDNS service is the kernel of the software and provides the actual DNS service running in the background. The Administration program offers a graphical user interface for supervising and controlling the MobileDNS service.

The files required by the software are explained further in the document.



*Picture 1. The components and files of the software.*

## 1.5 System requirements

MobileDNS has been developed for and runs on Linux operating system. The development and tests were done on RedHat5.1 and Redhat5.2 with kernel version 2.2.1 (and 2.0.35) but there should be no hindrance in compiling and running MobileDNS on other versions of Linux too.

You must have **egcs** or some other (gnu) c++ compiler installed to be able to compile the source. Compiling also requires (RedHat notation) **glibc-2.0.7-29** to work properly. Notice that there are many glibc-2.0.7 versions compiled out there, but MobileDNS requires a fairly new (October 1998 or later) version of the pthreads library that is included with glibc-packages. On a RedHat system, you can check the version of glibc by typing

```
rpm -q glibc
```

## 2. Installation

### 2.1 Compiling the source

Installing MobileDNS is easy. Unpack the **mobiledns.tar** or **mobiledns.tar.gz** somewhere (either

as root or normal user) using command

```
tar xvf mobiledns.tar
```

or

```
tar zxvf mobiledns.tar.gz
```

and then enter the created **MobileDNS/bin/** directory using command

```
cd MobileDNS/bin
```

Run **make depend** and check the **Makefile** if you're running something else than RedHat Linux. Finally run

```
make mobiledns  
and  
make mobilednsconfig
```

or to compile both at the same time

```
make all
```

to compile and link MobileDNS and the configuration application. If the compilation is successful you will now have two executables in the **bin/** directory, namely

```
mobiledns  
and  
mobilednsconfig
```

The compilation should be straightforward, but if you run into trouble where the compilation stops with an error message, check the **Makefile** for possible incompatibilities with libraries. You must have egcs or some other (gnu) c++ compiler, as well as glibc version 2.07 (with pthreads library as new as 4th quarter of 1998 at least). If you have all of this, then the usual error is that the actual library or archive -files are in some other directory than the makefile expects. Take a look at makefile, where it tries to find them (library paths) and use the command

```
locate <libraryname>
```

to find out, where these files are located in your system. Then either modify the makefile, or create a symbolic link to /usr/lib for them using

```
ln -s /<yourpath>/<libraryname> /usr/lib/<libraryname>
```

and try again. You can also type **make clean** to wipe out old compilations..

## 2.2 Installing MobileDNS

When you do have the binaries in the **MobileDNS/bin/** directory, become root and install the

MobileDNS by giving the command

```
make install
```

This command will do the following:

1. It creates `/etc/mobiledns/` and `/usr/sbin/mobiledns/` directories
2. It copies `mobiledns` and `mobilednsconfig` executables to `/usr/sbin/mobiledns/` directory
3. It copies all the configuration files (see 3.2) to `/etc/mobiledns/`

The copy overwrites, so if you had old versions of the files in those directories, make install will overwrite them with the compiled ones. You can uninstall MobileDNS (as root) by typing

```
make uninstall
```

Uninstall is non-destructive. It will remove exactly the two executables and the configuration files installed before, but nothing else. It will then try to remove the directories, but if there are something left in them, the directories are **not** removed.

Before you run MobileDNS, remember to configure it properly. Configuration will be described next.

## 3. Configuration

### 3.1 Configuring MobileDNS

MobileDNS uses five small configuration files (files ending with `.cfg`). This is because some of these files are frequently overwritten, either by MobileDNS, the user or by some mobileIP/Access point/DHCP/etc software. These files are pure ASCII and they are parsed line by line, with a '#' - character indicating a comment (parser naturally skips all comments). MobileDNS cache produces a dump file, called `cache.dump`, but this file is binary and should not be modified by the user or any program. A corrupted `cache.dump` may cause MobileDNS to not work properly. Finally the actual DNS-resolvers in various Linux programs will always check the file `/etc/resolv.conf` to see where our DNS-servers are located. Because of this we must be sure that no programs will ever overwrite this file, and it should always contain the one and only line described below (see also 3.2.1).

You can edit the `.cfg` files with your favorite text editor (`vi`, `emacs`, `pico..`). When you have installed (with `make install`) the MobileDNS, you must check and edit all of these four files. You must make sure you give your proper IP-address, the DNS-server(s) you wish to use and you should choose the care-of name for your mobile. Start by editing the main configuration file, called `mobiledns.cfg` and after that `ipaddress.cfg`, `nameserver.cfg`, `nameserver_user.cfg` and finally `careof.cfg`. The configuration files are very simple and self-explanatory, but you must be familiar with the DNS-concepts.

Last thing before starting the service, edit the `/etc/resolv.conf` to include only this particular line

```
nameserver 127.0.0.1
```

and nothing else. This will make sure that every program will send their DNS-queries to the

localhost, that is to the MobileDNS.

## 3.2 Configuration files

As explained in the previous section, all these files, except `cache.dump` are pure ASCII, and editable by the user or some program. The various configuration files are explained below.

### 3.2.1 resolv.conf

This file is Linux/UNIX-specific, but usually includes the nameservers to use and maybe some search order (to resolve the names) and domains. Since this file is checked by the various applications in the system, we must make sure it only includes the line

```
nameserver 127.0.0.1
```

forcing every DNS-query to be directed to the localhost. If you put or leave some other nameservers or definitions in this file, some of the DNS-queries will not be given to MobileDNS, but are rather sent out to those nameservers. This would increase the DNS-traffic going out of the mobile and is therefore unpreferable. If you leave out the above definition from `resolv.conf`, no DNS-query will be handled by MobileDNS.

### 3.2.2 mobiledns.cfg

This is the main configuration file of MobileDNS. There are exactly 14 significant lines, which can be modified. A typical configuration looks like:

```
careoffile # file containing host CareOf name information
/etc/mobiledns/careof.cfg
ipaddressfile # file containing host IP-address
/etc/mobiledns/ipaddress.cfg
userdnsfile # file containing user defined DNS server addresses
/etc/mobiledns/nameserver_user.cfg
localdnsfile # file containing local DNS server addresses
/etc/mobiledns/nameserver.cfg
homednsaddress # home DNS-server IP-address in dotted decimal format
194.100.71.129
concurrentdns # number of concurrent DNS queries
1
queryretry # Number of retries to failed DNS query
2
querytimeout # Timeout for DNS query
10
dnsport # DNS port to be listened
53
allowupdate # Are CareOf name updates allowed (1 = YES, 0 = NO)
1
allowforeignqueries # Are queries from other IP-addresses allowed (1 = YES, 0 = NO)
0
uselocaldns # Are queries to local DNS servers allowed (1 = YES, 0 = NO)
1
cachedumpfile # file containing cache dump
/etc/mobiledns/cache.dump
cachesize # Number of entries in local cache
256
```

The parameters are explained below:

- The four first definitions describe where the next four configuration files are located (and their names). The default place is in /etc/mobiledns/.
- **homedenaddress** defines the home DNS-address of our mobile's home network. It is the default nameserver when mobiledns is started and it is also used for care-of-name updates.
- **concurrentdns** tells to how many DNS-server a query is sent simultaneously. E.g. if you have defined three DNS-servers, you can send a request up to all those three simultaneously, hoping that at least one returns an answer. As this tends to create a lot more traffic over a possible radiolink, it may be preferable to keep this value as small as possible (must be at least 1 of course).
- **queryretry** defines how many send retries will be attempted before giving up and indicating that no such DNS-server exists or the network is out of reach.
- **querytimeout** defines how long to wait for an answer to queries sent out to nameservers.
- **dnsport** defines the socket port to listen for DNS-queries. Default port is 53.
- **allowupdate** defines whether or not MobileDNS will send a dynamic DNS update message to the home DNS-server every time the mobile's IP-address changes. Home DNS must support dynamic update (e.g. bind-8) and must be primary DNS for this to work properly.
- **allowforeignqueries** defines whether MobileDNS will serve queries coming from somewhere else than localhost.
- **uselocaldns** defines whether we wish to use the local DNS-servers, usually provided by some Access point software and stored in nameserver.cfg -file.
- **cachedumpfile** tells where to find and save cache.dump -file.
- **cachesize** defines the size of the cache. Default value is 256.

### 3.2.3 ipaddress.cfg

This file defines our acting IP-address. When the mobile moves from one network to another the IP-address may change. The IP-change is carried out by several system commands (ifconfig, route etc) and the MobileDNS is notified about this by a specific signal. MobileDNS will then reread this file. Notice that MobileDNS works perfectly well even if this IP-address is wrong, because MobileDNS receives our true IP-address from the system, not from this file. The IP-address from this file is used in updating the care-of name to the home DNS-server. A typical ipaddress.cfg looks like:

```
# host IP-address in dotted decimal format (a.b.c.d)
130.233.192.235
```

### 3.2.4 nameserver.cfg

This file defines the nameservers we wish to use. Even though you can define as many nameservers as you wish, it isn't of much use. MobileDNS will always use the first one in the list as long as it will respond fast enough. When that DNS-server goes out of reach or responds too slowly, then the possible next DNS-servers (the next server in the list) will be tried. With **concurrentdns** parameter in mobiledns.cfg you can define to how many of these DNS-servers a query is simultaneously sent to. Notice also that this file should be overwritten by the mobileIP/Access point software when we detect new DNS-servers in a new network. MobileDNS are then signaled to reread this file. A typical example looks like:

```
nameserver      # ns1.hut.fi
```

```
130.233.224.1
nameserver      # ns2.hut.fi
130.233.224.14
nameserver      # ns1.helsinki.fi
128.214.4.64
```

Even though you can edit this file by yourself, it is preferable to leave it for the Access point software and do your user specific changes in the next file described.

### 3.2.5 nameserver\_user.cfg

This file is meant for user's own DNS-server definitions. Here you can put your favorite DNS-servers and configure MobileDNS to use only them (from the administration program). You can edit this file by yourself or with the administration program. However, if you save your modifications from the administration program, this file will be overwritten. The syntax of this file is the same as for nameserver.cfg.

### 3.2.6 careof.cfg

This file is used to define your care-of name and care-of-domain. The care-of-domain is the subdomain in your home primary nameserver where you put your mobile's care-of-names apart from other statically defined names. The motivation for this is that then you can define in your home-DNS configuration file a whole domain dynamically configurable. The nameserver must be able to handle dynamic updates (like bind8). For example:

```
zone "co.asdf.org" {
    type master;
    file "mobiles";
    allow-update { 130.233.192.235; 127.0.0.1; };
};
```

The above example is from bind8/named configuration (named.conf). Refer to your nameserver manual for exact syntax. Under that domain you can then put your actual mobile's care-of-name by defining them as you would any statical name, for example (the mobiles-file):

```
@      IN      SOA  co.asdf.org. root.dzeijay.asdf.org.  (
                           199031701 ; Serial
                           28800     ; Refresh
                           14400     ; Retry
                           3600000   ; Expire
                           86400 )   ; Minimum
NS      juomala.asdf.org.
A       194.100.71.129
; Mobile hosts
mobile.co.asdf.org.      30      IN      A      130.233.192.235
```

An example careof.cfg (corresponding to the above examples):

```
careofdomain
co.asdf.org.
careofname
mobile.co.asdf.org.
```

### 3.2.7 cache.dump

Cache saves its contents into this file, either regularly or when signalled to do so. During operation, cache is being dumped to the disk every 50th query or after 60 seconds of the previous dump, which ever comes first. (Counters are verified upon query only. If MobileDNS is idle, no dump will be done.)

When MobileDNS restarts, cache will try to read this file. If the file is empty (0 bytes) or missing, then cache will start as empty. Otherwise it will check how old the saved records are and then either keep or discard the entries. Saving cache is useful when you have to shutdown your mobile for a short while. Notice that this file is binary and should not be altered by the user or any program. But you can always delete this file if desired.

## 4. MobileDNS service

### 4.1 Overview

MobileDNS service is the kernel of the MobileDNS software. MobileDNS service runs on the background and captures the DNS-queries from the client applications running on the local computer. To return an answer to the DNS-query, MobileDNS first checks its cache and if the answer is not in the cache, it then retrieves the answer from an external DNS-server or servers.

MobileDNS accepts four types of input from the outer world. It listens for DNS-queries in port 53, it communicates with the administration program, it listens for system signals and it reads configuration files upon startup and signal arrival.

### 4.2 Starting MobileDNS

MobileDNS service is started to the foreground with the command `mobiledns`. The service can only be started by a superuser, or root. (With the command `su` one can turn himself into a superuser.) If the user is not a superuser, MobileDNS service declines to start and reports an error.

To have `mobiledns` run on the background, and leave it running even after you log out from the computer, enter command `make run`

This command starts `mobiledns` process to the background. The command runs a program called `nohup` which does the actual trick of putting a process to the background.

The executable can take three arguments. If no arguments are given, default values are used. Usage is following: `mobiledns [-d <debuglevel 1..5>] [-c <configuration file>] [-f <debug file>]`. The debuglevel argument is described in chapter 4.5. The format and purpose of the Configuration file argument is explained in chapter 3.2.2. The debug file is a file where the debug and error statements are written.

Default value for debuglevel is 3. Default value for configuration file is `"/etc/mobiledns/mobiledns.cfg"`. If debug file is not specified, debug statements are written to the standard output. (make run command specifies `"/etc/mobiledns/debug.dump"` as the default debug file.)

Note that the standard name server, named, can't run at the same time as MobileDNS. This is because they both try to acquire the DNS port 53.

## 4.3 Stopping MobileDNS

MobileDNS service is stopped by sending the signal INT to the mobiledns process. The signal is sent with the command `killall -INT mobiledns`. Sending a signal INT is equivalent to pressing CTRL+C if the process is running on the foreground.

Note that contents of the cache or the current configuration data are not saved to the disk by signal INT.

## 4.4 Commands

Besides starting and stopping MobileDNS service, there are five other commands understood by the service. The commands are all invoked by sending a specified system signal to the mobiledns process.

If an access point component was available on the network, invoking the below commands would be taken care by it. Since this is not the case and we invoke the signals ourselves, the signalling commands are being documented in this user manual.

For commands that require data from the configuration files, the files should be filled before sending the signal.

### 4.4.1 Access point update

This command notifies the MobileDNS service of an access point (a network) change which means that there may be new DNS-servers that MobileDNS must communicate with. Upon this command, MobileDNS service reads the configuration files from the disk and updates its internal state.

The command is invoked by sending a signal ALRM to the mobiledns process. The signal is sent with the command `killall -ALRM mobiledns`.

### 4.4.2 Cache and configuration dump

This command makes the cache save its contents to `cache.dump`, and all configuration data is saved to `mobiledns.cfg` and `nameserver.cfg` files.

The command is invoked by sending a signal HUP to the mobiledns process. The signal is sent with the command `killall -HUP mobiledns`.

### 4.4.3 IP-address change

This command notifies the MobileDNS service that the IP-address of the mobile computer has changed. MobileDNS reads file `ipaddress.cfg` and sends it new IP-address to the home DNS-server.

The command is invoked by sending a signal PROF to the mobiledns process. The signal is sent

with the command `killall -PROF mobiledns`.

#### 4.4.4 Entering blocked state

This command notifies the MobileDNS service that the mobile computer has entered a blocked region where communication with the DNS-servers is impossible. MobileDNS stops sending DNS-queries to the network. An error "unexistent domain" is returned as a result for each DNS-query.

The command is invoked by sending a signal QUIT to the mobiledns process. The signal is sent with the command `killall -QUIT mobiledns`.

#### 4.4.5 Leaving blocked state

This command notifies the MobileDNS service that the mobile computer has left a blocked region and communication with the DNS-servers can be performed again.

The command is invoked by sending a signal TERM to the mobiledns process. The signal is sent with the command `killall -TERM mobiledns`.

### 4.5 Error reporting

If mobiledns is started with a command 'make run', the debug statements and errors occurring during the run are written to file "/etc/mobiledns/debug.dump". In case there occurs a malfunction in MobileDNS, one should check this file to pinpoint the problem.

By using the -f argument of mobiledns, one can control where the output will be written, either to a user specified file or to the standard output.

There are five (debug) levels of output that MobileDNS generates. Most of the output was an aid for the development process but the output can be used for troubleshooting as well.

The levels of output are: INFO 1, MESSAGE 2, WARNING 3, ERROR 4, FATAL 5. The levels are in order of increasing severity. Level 1 includes all other levels and provides the largest amount of output data. It is not recommended to use levels below 3 because vital output data can be lost.

## 5. Administration program

### 5.1 Overview

The administration program is used to configure and collect information from the MobileDNS service. User can add and remove resource records (also referred as entries) from MobileDNS cache, browse the records currently in cache and set the name servers that MobileDNS uses.

The administration program can only be used with superuser privileges. This is mainly because also MobileDNS must be run as root. The second reason is that MobileDNS can be misconfigured easily with the administration program. However, this restriction should not pose any problems since the MobileDNS is usually run on a single user (possibly laptop) computer.

The administration program should mainly be used to set some default values and to monitor the functioning of MobileDNS. The MobileDNS service does not require constant supervision but functions well even if left totally unconfigured.

## 5.2 Starting the administration program

The administration program is started by giving the command `mobilednsconfig`. It then connects automatically to MobileDNS service if MobileDNS is currently running. If MobileDNS is not currently running the administration program will terminate. The administration program takes no arguments.

## 5.3 Closing the administration program

The administration program can be closed by pressing the 'Exit' button from main window. It can also be exited by closing the window or sending the proper (for example `kill`) signal to the `mobilednsconfig` process.

## 5.4 Listing DNS records

The browsing of DNS records currently in MobileDNS cache can be done in main window. When opened the program will automatically fetch the contents of MobileDNS cache and displays them on the main window list. After that the current cache contents can be displayed by pressing the 'Refresh' button.

The fields in the main window list have the following meanings. The typical values for each can be seen in picture 2. List entries can be sorted by pressing the buttons on top of the list. Each column button (except Qtype and Atype) will arrange the entries by the values in that column.

- **Name** means the question part of DNS message. It usually is an alphabetical name or, in the case of PTR query, an in-addr.arpa-ended reverse IP number.
- **QType** is the type of the query. It can be A (normal lookup), PTR (reverse lookup), NS (name server query), MX (mail exchanger query), CNAME (a query for an alias), or HWINFO (hardware info query).
- **AType** is the type of the answer. It can be different or the same as Qtype.
- **Data** represents the answer part of DNS message. Its contents depend mainly on the type of the query. In most cases it is a single IP number or a character string.
- **Time to live** is how long the entry will be kept in MobileDNS cache before it is discarded. Time to live is measured and displayed in seconds. There are two special values for TTL field: PERMANENT and ALWAYS OUT. PERMANENT means that the entry has infinite TTL and is always found in cache. ALWAYS OUT means that the query can't be cached. MobileDNS will send this kind of query always out to external DNS-server(s).
- **Cache hits** tells how many times this particular information has been needed and retrieved from the cache.

Some statistical information from MobileDNS service is also displayed in main window. The statistics have the following meanings:

- **Total queries to MobileDNS** means the total number of queries the service has received.
- **Queries sent out** is the number of queries to external DNS-servers.

- **Cache hits** means the number of answers found directly in the cache.
- **Average MobileDNS response time** gives the average time in milliseconds, that it took MobileDNS to answer to query.
- **Average external DNS response time** gives the average time in milliseconds that it took some external DNS to answer query MobileDNS sent out. i

MobileDNS Configuration Application						
Name	GType	AType	Data	Time to live	Cache hits	
50.224.233.130.in-addr.arpa	PTR	PTR	alpha.hut.fi	2574	2	
alpha.hut.fi	A	A	130.233.224.50	PERMANENT	0	
alpha.hut.fi	MX	MX	cc.hut.fi	2712	1	
www.hut.fi	A	CNAME	info.hut.fi	2660	4	

SERVICE STATISTICS:

Total queries to MobileDNS	22	Average MobileDNS response time	1941 ms
Queries sent out	15	Average external DNS response time	4141 ms
Cache hits	7		

Picture 2. The main window of MobileDNS administration application.

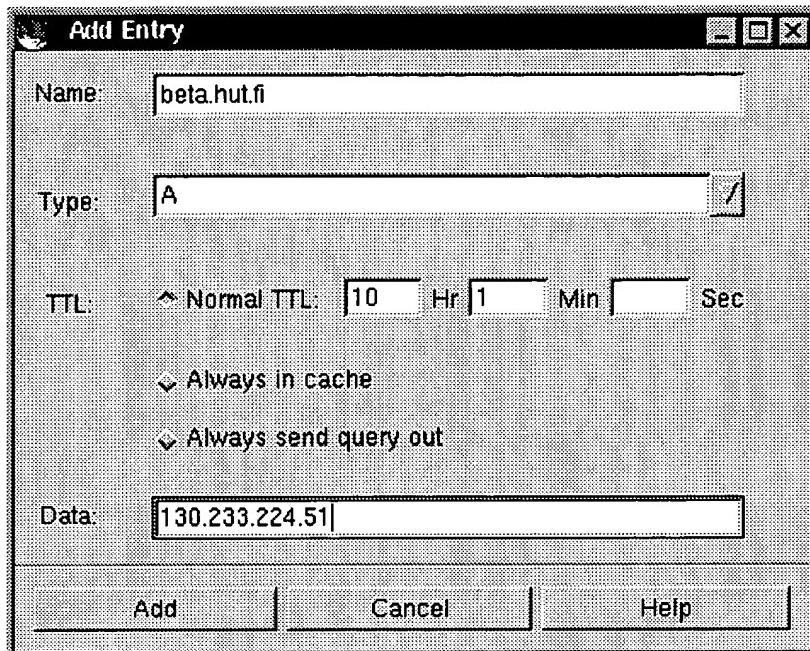
## 5.5 Adding a DNS record

You can add DNS records to MobileDNS cache by the following procedure. First press the 'Add an entry' button in the main window (Picture 2). The dialog for adding DNS records opens. Fill all the fields in the dialog and chose the entry type from drag-down menu. The fields have following meanings:

Name of the field.	Short description	Possible values and some examples
Name	Name means actually the question, that is answered by rest of the resource record. The form of the question depends strongly on the Type field.	cs.hut.fi (Type A), 12.121.21.1 (Type PTR), www.hut.fi (Type CNAME),
		A - normal address query,

Type	Type is the type of the query. The type that can be given here is the type of the question.	PTR - reverse name lookup NS - name server query, MX - internet mail server query, CNAME - name alias lookup, HWINFO - hardware info query, TXT - free text string
TTL	<p>There are three options for TTL (Time To Live):</p> <ul style="list-style-type: none"> <li>◦ Normal TTL means that user can specify the exact time that this entry remains in cache.</li> <li>◦ Always in cache means that the entry does not expire from the cache.</li> <li>◦ Always send query out also means that the entry does not expire, but MobileDNS must send this kind question always out. This is a way for a user to tell MobileDNS, that this entry will never be cached.</li> </ul>	-
Data	<p>This is the part that answers the question presented by the Name field. It also depends strongly on the Type field:</p> <ul style="list-style-type: none"> <li>◦ Type A and NS data fields consist of IP-address.</li> <li>◦ Type PTR data field consists of reverse name lookup result.</li> <li>◦ Type MX data field is: first the mail server name, then one space, and then IP-address translation of the name.</li> <li>◦ CNAME data field is the actual name of the machine.</li> <li>◦ HWINFO and TXT contain some freely formatted data string</li> </ul>	123.123.123.12 (Type A) 12.12.132.13.in-addr.arpa. (Type PTR) vipunen.hut.fi 130.233.249.7 (Type MX) alpha.hut.fi 130.233.224.50 (Type CNAME)

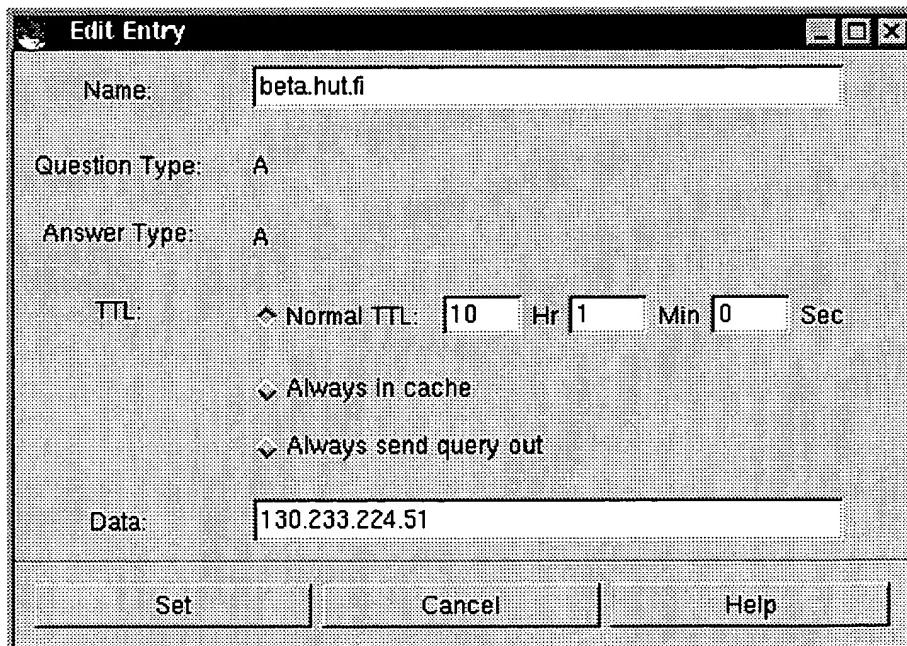
When all fields are set properly press the 'Add' button to send the entry to MobileDNS cache. The entry also appears in the main window list. If you don't want to add the entry you edited to the cache, press the 'Cancel' button to return to main window without doing any changes. Caution: currently there isn't any kind of checking for the inserted values. By adding wrong types of information (for example false IP numbers) the MobileDNS will function incorrectly.



Picture 3. The dialog for adding an entry to MobileDNS cache.

## 5.6 Editing an existing record

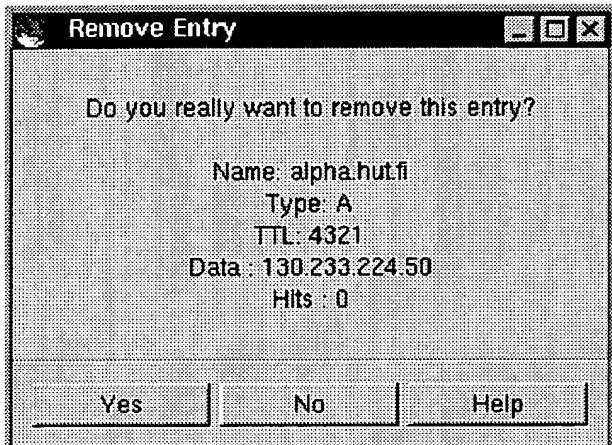
To edit Existing records first select one DNS record from the main window list and then press 'Edit an entry' button. A dialog (picture 4) will appear. It contains all the same fields as a dialog for adding DNS records and functions similarly. The only difference is that the type fields (Answer Type and Question type) are only for viewing and can't be changed. After editing fields click 'Set' to confirm the changes or 'Cancel' to discard them.



Picture 4. The dialog for editing an existing entry in MobileDNS cache.

## 5.7 Removing a DNS record

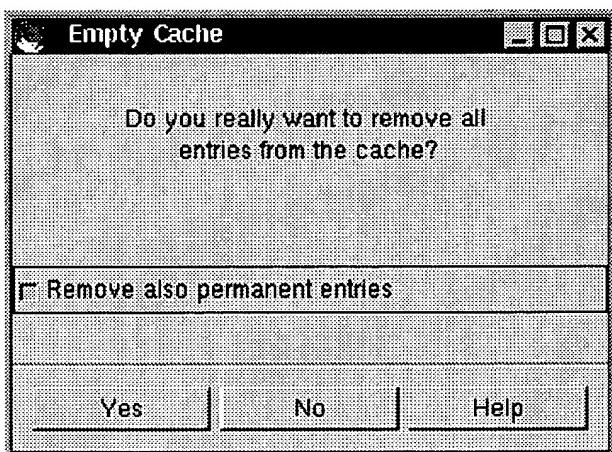
To remove one DNS record from the list displayed in the main window select the entry from the list by first clicking it and then click the 'Remove an entry' button while the entry is highlighted. A dialog appears (Picture 4) that asks for confirmation. Click 'Yes' to remove the entry and 'No' to return to main window without removing the entry.



Picture 5. The dialog that confirms removing of an entry from MobileDNS cache.

## 5.8 Removing all DNS records

To remove all DNS records currently stored in the MobileDNS cache press the 'Empty cache' button. A dialog appears (Picture 5) that asks for confirmation. It also allows user to specify that all permanent entries are deleted by checking the 'Remove also permanent entries' button. Click 'Yes' to empty the cache and 'No' to return to main window without removing anything.



Picture 6. The dialog that confirms the removing of all DNS records from MobileDNS cache.

## 5.9 Managing the name servers

To see the name servers that MobileDNS uses or to change them press the 'Set Name servers' button. A dialog will appear (Picture 6) that displays the name servers currently used and also a

number of them to be used concurrently. There are three kinds of servers:

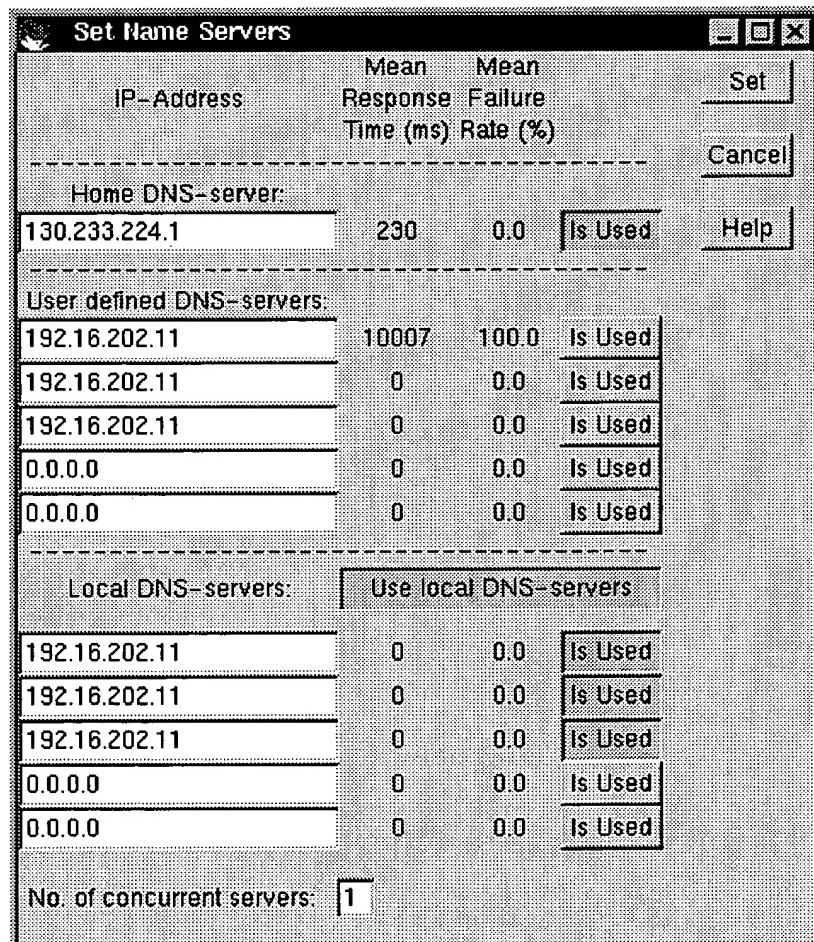
- **Home server** is the DNS-server, that user would normally use, for example the firms own DNS-server.
- **User specified servers** are some other DNS-servers, that user wants to specify.
- **Local servers** are the servers given to MobileDNS by the last access point. User can elect to use them by pressing down the 'Use local name servers' button or make them to be ignored by pressing up the same button.

There is some statistical information associated with each server:

- **Mean response time** is the average time it takes to get the answer from the server. Time is shown in milliseconds.
- **Mean failure rate** is the percentage of failed queries with this server. A high failure rate usually means that the server or its network is under heavy traffic and packets are lost.

Each server listed can be selected to be used or ignored by toggling the '**Is Used**' button that appears after statistical information. However, at least one server must be selected as active.

To confirm the changes to the name servers and concurrency values, press the '**Set**' button. To close the window and return to the main window without doing any changes press the '**Cancel**' button.



*Picture 7. The dialog for setting name servers that MobileDNS uses and setting the maximum number of concurrent calls to them.*

## 6. Glossary

### Access point

An imaginary network component that would provide the access to a foreign network and information of the foreign network

### Bind

Berkeley Internet Name Domain - the most common name server software in the Internet

### Care of name

An IP-name in the home name server that refers to the current IP-address of the mobile computer

### DNS

Domain Name Service

### Egcs

A GNU C++ compiler

### RedHat n.n

A Linux distribution from RedHat company

### Resource Record, DNS Record

A record containing DNS data (IP-name and its IP-address, for example)

### Root

A superuser (or an administrator) in Linux, has full rights to the operating system

### TTL

Time To Live, associated with data, specifies the amount of time that the data is valid. When TTL expires, the data should be considered as invalid.